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ABSTRACT

This unit is intended to examine the causes of the endangerment of Florida's plant and animal species with a detailed look at varied ecological systems. Individual lessons are designed to be used either by individual students progressing at their own rate or by small groups. Units may be modified for use by large groups. (Author/RE)

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Endangered Species

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"... I think what's going to have to be done in the next three or four years is for everyone, but especially for the students who are just entering the world, to re-evaluate the whole position in this country that we're facing in regard to what we do for money and what money will buy and what money won't buy."

"... What we're going to have to do is to change the patterns of consumption in this country and in the rest of the world. The same thing is true of energy... we're going to have to think in terms of energy units instead of in terms of money..."

"... So we have to learn something new, and it's going to be rough."

Margaret Mead
Boston, 1975

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I. INTRODUCTION

Each of us is a part of the environment. We affect the environment and it affects us. A safe, healthy environment is essential for our existence. Yet, we have caused serious changes about us. We have brought about an environment that soon may no longer meet our requirements for survival. We must examine ourselves in order to understand what has caused these environmental changes.

Early man's effects upon his environment were minimal. His role was one of participating in environmental changes as they happened, rather than causing them to take place. He found food, water, and shelter more by chance than by design. He was extremely dependent upon nature, barely managing to eke out an existence from his surroundings. Primitive man still has this role, but modern man has progressed far beyond a humble dependence upon what his environment happens to be or what happens to take place within it.

Modern man is able to cause profound changes in his environment. In this he is unique. All other species have been limited to the effects they could cause by the force of their own bodies. But modern man, through the use of his intellect and technology, has multiplied the effect of his body many times over. Using these effects, he has changed the environment-- the land, the air, the water, and the living things of earth. Some of these changes have been beneficial, many have been harmful.

Now man the changer must find ways to maintain an environment suitable for himself and all other living things. Only recently has man realized his responsibility for maintaining a healthful environment. The serious environmental problems we are facing today demonstrate the impact modern man has had upon the environment.

We have the intelligence and ability to meet the crisis of the environment. To solve this crisis, we will need to re-educate ourselves about our responsibilities to nature. We hope that this program will aid in that re-education.

II. OVERVIEW

This program is designed to help students to understand their environment. In this program, students are encouraged to explore their environment from an energy systems approach. Earth's processes and systems are examined in terms of energy flows. The students consider the complex workings of "spaceship earth" and become aware of the effects modern man is having on it.

Students, however, differ in their ability to learn. They differ from region to region, from age level to age level, and from class to class. Moreover, no one student learns equally well in all modes of instruction. The components of this program have been designed to overcome such disparities of learning.

In this program, students use a variety of instructional modes and media. By hearing, seeing, feeling, and doing the students become involved in a variety of learning experiences.

The various components of this program are readily adapted to the different modes of instruction commonly used today by students in their learning activities. Using these components for individualizing instruction, a student can work alone and progress at his own rate. These materials may also be used by students in small groups of three or four as they stimulate one another's thinking, exchange thoughts, and discover ideas. In some cases, the students may choose to work with the materials in large groups. The program is designed to allow

and to encourage such flexibility in its use.

MAJOR OBJECTIVES

There are three major objectives to be achieved through student involvement in this program.

1--- The students will discover basic information and understand basic concepts about environmental systems and will demonstrate their comprehension by appropriately applying the concepts in activities.

2--- The students will be able to identify major environmental problems, will be concerned about these problems, and will be able to discuss some ways these problems can be resolved.

3--- The students will demonstrate a personal commitment by taking actions which will aid in the prevention or solution of environmental problems they observe.

PROGRAM STRUCTURE

The materials included in this program are open-ended in the development of content and concepts. In their use of these materials, the students are offered a wide range of options for further development of information and ideas and for the application of what they find.

The program "Your Florida Environment" consists of three modules:

Module #1 --- "How Things Work"
An exploration of Earth processes and systems from an energy point of view. Energese, the energy system language used throughout the program, is explained.

OVERVIEW (cont.)

Module #2 ---- "Florida's Urban Environment"
Beginning with the historical development of Florida from an energy systems approach, this program deals with the urbanization process in Florida and explores where it is leading.

Module #3--- "Endangered Species"
An examination of the causes of the endangerment of Florida's plant and animals species with a detailed look at Florida's varied ecological systems. A view of the complexity of the balance of nature and this relationship to man.

Each module contains one sound-filmstrip and a Teachers Guide. The sound-filmstrip is designed to operate either manually or automatically by cassette tape player and filmstrip projector.

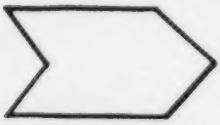
The subject matter developed in these materials is appropriate for students from cities, suburbs, or rural areas. These materials are directed at students from grades 5 and above.

ENERGETICS LANGUAGE

The "Your Florida Environment" programs use a pictoral language that symbolized systems relationships. This language, Energese, ** is used to describe the complex processes and systems involved in understanding the environment. The symbols used in this language are:

ENERGY SOURCE symbol represents a source of energy from outside the system such as the sun, fossil fuel, the water from a reservoir, or iron ore from the ground.

ENERGY STORAGE symbol (tank shape) shows the location in a system for storage. Examples are a grocery store, into which potatoes are moved and later removed, or a fuel storage tank. Some work must be done by some other unit in order to move the energy in and out of the storage.



INTERACTION symbol shows the coming together of two or more energy sources needed within a process in order to produce the result. An example is the interaction of the farmer's labor, sunshine, fertilizer, soil, etc., to produce a crop.

a) THE PATHWAY symbol is used to indicate the flow of energy from one part of the system to another part.
b) THE DASHED PATHWAY symbol is reserved to show the flow of money.

THE PRICE symbol shows that within man's system there is usually a flow of money to pay for the energy. An example is the exchange of money in a grocery store for the food that we buy.

THE HEAT-SINK symbol. Heat, the random thermal motion of molecules is the ultimate fate of all energy. As energy flows through any system it becomes degraded, i.e., it loses the ability to do further work. Three different examples of the way in which energy degrades are: (1) the loss of energy due to friction (2) the natural depreciation that occurs when any energy is stored (3) the consumption of energy in order to run or process any type of energy interaction.

THE PRODUCTION symbol represents a self-maintaining production population, such as trees and grass. It also contains storages and interactions and has input energy such as sunshine combining with raw materials to produce a useful output such as trees. While production unit is normally associated with plant operations, it can also be used with any production process that contains a cycling, self-limiting material flow.

THE CONSUMER symbol represents a self-maintaining consumer population, such as deer or the residential sectors of our own society. Within it are combinations of storages and interaction units.

** Energy Crisis to Steady State, H.T. Odum

MODULE # 3 "ENDANGERED SPECIES"

The teacher is a very important factor in the success of any program. This part of the guide contains ideas for the use of his module that can help you obtain maximum student participation with a high level of achievment. These ideas, guidelines, observations, activities, and practical suggestions are offered for your use. Any approach or teaching pattern offered is not intended to show you the way to use the program. As the teacher, you will develop many ideas and approaches to suit your style of teaching to fit the learning patterns of your students. Use whatever works best for you and your students.

MODULE # 3 "ENDANGERED SPECIES"

OBJECTIVES:

Students will be able to discuss the basic ecological concepts of the Floridian environment, systems ecology, the endangered plants and animals of Florida, their needs and function in the ecosystem, the reason they are endangered, and the general recommendations for their protection from extinction.

CONCEPTS DEVELOPED:

Complex ecosystems are more diverse than simpler ones.

The more diverse an ecosystem is the more stable it is.

There is interdependence of parts of an ecosystem.

Members of an ecosystem perform services for the maintenance of the system and thereby are successful species.

Energy flows from the sun through an ecosystem.

There are 484 species of plants and animals in Florida which are threatened by extinction.

Habitat destruction contributes to the demise of more species of plants and animals than any other environmental hazard.

Monocultures are not tolerated in nature. They are the simplest possible system, more prone to disease and destruction than any other.

Diversity is needed for survival in man's systems as well as nature's.

There needs to be a three-way partnership formed for the well being of the life support systems of earth between cities, farms and wilderness with equal economic emphasis for all.

(1) Florida's Endangered Species
(2) Produced by the Florida Audubon Society.

(3) Take a good look Florida... This may be your last chance to see the Florida Panther.
(4) The Sandhill Crane,
(5) the Pine Barrens Tree Frog,
(6) the American Crocodile,
(7) the cave crayfish,
(8) the Elk-horn coral,
(9) the Florida Tree Snail...

(10) Take a good look Florida... This may be your last chance to see the sand dunes,
(11) the mangroves,
(12) the marsh,
(13) the hardwood hammock,
(14) the cypress swamp,
(15) the Florida scrub,
(16) the coral reef,
(17) the pine flatwoods...

(18) It has taken more than four billion years for the earth's biosphere to evolve and develop as it is today--An incredibly complex diversity of organisms function as a single, interrelated self-sustaining ecosystem.
(19) There are 484 species of plant and animal life in Florida which may be on the verge of becoming extinct. What nature has taken four billion years to build, we are destroying in less than one century. Why should we care about these plants and animals ? What do they have to do with us ? Is it true that the extinctions of certain species of plant and animal life indicate a deterioration of our life support systems ?
(20) Florida is rich with a diversity of ecosystems, from the very complex to the simple. In the complex systems such as the sub-tropical hardwood hammock and...
(21) the coral reef, climatic conditions are relatively constant. Together many species of plants using energy from the sun and elements from the earth produce food for the entire system. On the coral reef, the...
(22) phyto-plankton form the food and energy basis for this system. As some animals and plants die, fungi and bacteria use this organic matter. This process provides a recycling mechanism for the system.
(23) Organic matter is reduced to simpler compounds and is reused by the plants.
(24) In the complex systems, there is no one dominant species of plant or animal. Both the producers and microorganisms are regulated by specialized consumers. These insects are so special-

ized that they eat only the leaves of certain plants or certain micro-organisms. Since there is no one plant dominating the complex ecosystem, the specialized consumer does not have a chance to become epidemic.

(25) In the same manner, small fungus-eating insects keep the micro-organisms from becoming too numerous. If conditions arise for any one plant to accelerate its growth and become dominant, it will be counterattacked by accelerating action by the...

(26) consumers whose small size gives them a rapid reproduction time.

(27) There are higher level consumers (such as lizards,...

(28) spiders, and...

(29) frogs) which are less specialized in their eating patterns. They can shift from eating one species to another if either becomes so numerous that it is easier to find. These higher order consumers also need a variety of foods in their diet to allow for the more complex functions they need to do -- rapid body movements, elaborate and diverse behavior....

(30) Thus, every living thing in the complex ecosystems has a job to do. It controls and is controlled by the system. Diversity is maintained. The stability of the system is maintained through diversity. From the sun to plant, to specialized consumer, to higher level consumers, to fungi and microorganisms and back to plants, energy flows from the sun throughout the system.

(31) It has been said that nature reaches its most appealing manifestation of beauty, intricity and mystery in the very complex systems. Since the species are so diverse and the jobs they do are so specialized, they have adapted color codes and behavioral characteristics to organize and keep track of the circuits of energy flow throughout the system.

(32) They are so efficient at utilizing all organic matter that they leave very little to the fossil record. As stability of an ecosystem is reached through diversity of its parts, so is the stability of the entire peninsula of Florida reached through diversity of its separate ecosystems.

In the simpler ecosystems of Florida conditions for life vary with wind, daylight, rainfall, salinity, frosts, fire and tides.

(33) Estuaries contain a higher salt content during droughts than they do after a heavy rainfall.

(34) Fires started by lightning burn through the pine forests in the wet seasons.

(35) The scrub areas are subject to long periods of drought.

(36) The cypress swamps have plants adapted to having their roots stand in water for months at a time.

(37) Tidal flats go nearly dry, when the moon is in full phase.

(38) Beaches are rivers of flowing sand where plants must withstand the salt spray.

(39) Caves are low energy systems where the animal and plant life must live in a world devoid of sunlight.

(40) These systems are not as complex nor as stable as the subtropical forest or the coral reef. Energy flows into the less complex systems in surges or oscillating patterns.

(41) Here great amounts of the plant and animal's energy is devoted to survival and replacement of losses in populations. Little energy is leftover for making new species and diversifying them. Here one species must be able to perform a variety of functions.

(42) A surplus of organic matter is produced by this system. While the patterns of color and complex behavior may be lacking, nature is beautiful and exciting in a different way. There are dominant species in these systems which have out competed their rivals for survival.

(43) There are great blooms, pulses,

(44) crops,

(45) migrations.

(46) Humankind is a part of this system and can secure food from it.

(47) Here the role of the predator is more important for the well-being of the system. When populations of some species bloom, the predators feed on them--- thus culling out the weak and infirm, controlling populations and keeping the stocks healthy and strong.

(48) The populations of the predators are controlled by the availability of prey. Thus there is a system of checks and balances in the simpler systems also.

(49) The less complex an ecosystem is, the more fragile it is. Species of plants and animals have developed adaptations for survival in these specialized environments. So much so that if these environmental conditions were to change, the species of plants and animals would either have to re-adapt, move away, or die.

(50) Every plant and animal has a job to do for the system. Through the process of natural selection those plants and animals which did not perform a function for the system died out or modified themselves so that they could. For example, the plants that survive and become dominant in an ecosystem are the ones that have ways of getting more energy from the sun than the others. Since they take in more energy, they also produce more food for the consumers. Their mere existence in a system means that they perform a job for the system.

(51) Squirrels and chipmunks survive in a system because they have learned to store food for a time when it may not be as plentiful. They sometimes forget where they buried their nuts and have inadvertently planted more trees. Simply by surviving, they aid the system.

(52) An insect will eat no more than seven percent of its host plant if the plant is interspersed with different ones through the system.

(53) The insect often performs the extremely valuable function of pollinating its host as well as other plants.

(54) And why do flowers have such beautiful blossoms or odors ? For the mere sake of attracting a would-be pollinator?

(55) By eating frogs, our friends the snakes control populations. In turn, their numbers are controlled by other predators.

(56) Whether it is eating a species or being eaten by another, every living thing keeps a network of energy flowing from the sun throughout the ecosystem, and the survival of the system depends upon the survival of each individual species.

(57) Graphically, we can show each species' job in a system by looking at what it needs for survival, and correspondingly, what needs it for survival. Let's look at the foodweb of a common Florida plant community, the river swamp, where soil is poorly drained and there is periodic flooding. The dominant trees will include the cypress, sweet bay and loblolly bay trees, black gum, maples and other trees that can withstand the flooding. Beneath these trees we find smaller trees, shrubs, and ferns and mosses making up the ground covers. Many animals exist here, including insects, spiders, tree frogs, snakes, a variety of birds, mammals such as native rodents, rabbits, armadillos, bobcat and deer.

(58) The abundant cover and lush vegetation makes the river swamp a good place for them to live... If one species of plant or animal is taken out of this river swamp system, the entire network will have to readjust itself so that energy can continue to flow throughout. We cannot always predict what will happen when an ecosystem is altered.

(59) We do know that the removal of the vegetation in this river swamp will cause the animals to either migrate to another similar environment and do battle for a territory there or stay and try to adapt to the new conditions. If they are unsuccessful, they die. Drastic changes such as this often occur when land is cleared for development by man.

(60) The removal of all insects may cause the demise of the plants, for there would be nothing to pollinate them.

(61) In fact, if we plucked one strand of the web, we would feel the vibrations throughout the system.

(62) The sand pine scrub is one of Florida's most fascinating plant communities.

(63) Here the short-needled sand pine is the dominant species. This plant community exists only on prehistoric coastal dunes about forty miles inland from our present coasts. Because of some of its coarse, sandy soils which are well drained, it has been extensively developed for housing and citrus farming.

(64) The sand pine, scrub oak, small rosemary shrubs,
(65) prickly pear cactus, spiders, scrub jays, lizards, gopher tortoises, foxes, snakes, skunks, hawks, deer, opposums, quail, racoons, saw palmetto, insects, quail, owls, bears, panthers,
(66) lichens, and the ever-present fungi and bacteria all live here.

(67) The animals and plants here have adapted to the hot, dry conditions. The scrub is often referred to as the closest thing to a desert in Florida.

(68) Another way to graphically show the interrelationships in a system is to construct a productivity pyramid.... Each building block represents a trophic level in the sand pine scrub system. The producer level - the large block on the bottom of the pyramid - represents all the plants of the system (rosemary, saw palmetto, sand pine, scrub oak, cactus). The next level consists of all the herbivores in the scrub - those consumers of the plants (raccoon, quail, deer, insects, scrub jay). Next comes the first carnivore level comprised of those animals that feed as predators, scavengers or parasites on the herbivores (vultures, snakes, lizards, fox, opossum). The secondary carnivore level consists of animals that feed on animals of the first carnivore level (hawks, owls). The tertiary carnivore level is made up of animals that feed on the secondary carnivores (bear, panthers). It is difficult to assign all carnivores to any one level, for they need a variety of foods in their diet and often feed on more than one trophic level. Our diet consists of a mixture of food from both plants and animals, and we are therefore dependent on several trophic levels to provide us with the variety of foods we need.

As in all systems, there are two laws governing the passage of energy from one trophic level to another.

(69) 1. The energy flowing into a system must equal the energy flowing out of the system.

(70) 2. With each energy transfer some energy is lost as unusable heat.

(71) Our productivity pyramid shows the amount of food available at each trophic level. The productivity block consists of the net yield of plant production. Herbivores depend on production for their food supply. It is possible for herbivores to eat so many of the food producers that the ecosystem collapses, but we know that their population is usually regulated by the carnivores of the next trophic level.

Only a portion of the food eaten by herbivores and carnivores is retained in their bodies. Some parts of the food are not digestible and are cast out. Much is used for immediate energy to maintain their bodies. Some is lost as heat. The rest is

used for bodily growth. This growth is the productivity of the trophic level. The number of trophic levels in a system is limited to the amount of energy available to each succeeding level. The last level will have only enough energy to support itself.

(72) Caves contain the simplest ecosystems in Florida, and they are just as fascinating as the most complex. Much of Florida is underlined with limestone which provides a vast opportunity for the development of caves. There are no green plants in the darkness of the caves, so animals must get their food in a more round-about fashion than consumers do outside. The outside world actually supplies the cave dweller with food.

(73) Fecal matter from roosting bats and surface detritis provide most of the energy necessary to sustain life in caves -- the birth and growth of each individual ; the movements of legs and feelers and jaws; the breathing and heartbeats; the pursuits, captures and escapes. This energy enters the cave through sink holes and concentrates at the input areas. This is a minute quantity of food compared with that available in the outside world. Sometimes the caves flood and move this energy throughout the cave, but this is rare.

(74) Cave organisms congregate at the energy sources. Sometimes the populations of cave dwellers centered around the energy islands represent the nucleus of the entire species. We saw that in more complex ecosystems animals were specialists, eating only certain kinds of plants and animals that are easy to find. The cave dwellers cannot afford to be specialists -- they eat what happens to come their way and cannot afford to spend energy pursuing meals farther away.

(75) Cave animals have adapted to their lives in total darkness. Many no longer develop eyes or color because they serve no function for survival. More bodily energy is then available for developing those organs that enable the animal to get more energy.

(76) These cave crayfish resemble their cousins who live above the ground but have no color or eyes, have longer antennae and sleeker bodies. They can fast longer also.

In the simpler systems, the slightest disturbance can wreak havoc throughout. They are more easily disturbed than the complex systems. If the bat detritus were not allowed to go into the caves, most if not all of the species therein would die; they are not equipped to migrate or rapidly readapt.

(77) We have learned to simplify ecosystems in order to obtain large quantities of food,

(78) housing and industry.

(79) We have simplified others in order to control nature for our benefit. But when we simplify, we are not really sure where our manipulation will end in the ecosystem.

(80) As we have seen, a monoculture of any sort does not occur naturally in an ecosystem ; if one species becomes too numerous, there are controls to keep it in check and to preserve the stability of the system.

(81) We are creating monocultures in Florida, and our ecosystems are showing the effects . Large cities composed of buildings, blacktop and people are human monocultures whose effects spread to surrounding ecosystems. Famine and disease eventually stop the growth of these human monocultures.

(82) In Florida, the endangerment by extinction of nearly every wild species of plant and animal is a direct result of the effects of the human monoculture. It is entirely possible that humans could be starting a reversal of other evolutionary processes that developed our functioning biosphere. What we do not know is at what point in time the process of degradation and destruction will become irreversible and our life support systems will collapse.

(83) We are literally using machines to scrape entire ecosystems off the surface of our land. With their life support systems disrupted, only those animals which can migrate survive. The plants, bases of all productivity, have no choice but to die.

(84) Habitat destruction as a result of forest cutting, ...

(85) marsh and swamp drainage, agriculture,....

(86) road and highway construction,...

(87) and housing developments threaten the majority if not all of the animals and plants that are presently endangered.

In the state's central range, we have endangered such species as the..

(88) short-tailed snake,...

(89) gopher frog,...

(90) gopher tortoise,...

(91) scarab beetles,...

(92) sand skink,...

(93) panther,...

(94) black bear,...

(95) pocket gopher,..

(96) Florida weasel,...

(97) In the coastal plains, our simplification of ecosystems has endangered

(98) the Pine Barrens tree frog,

(99) Suwannee cooter,

(100) four-toed salamander,

(101) mole snake,

(102) southern copperhead,
(103) wood stork,
(104) everglades kite,
(105) the manatee,
(106) panther,
(107) black bear,
(108) pallid beach mouse,
(109) sparrow hawk,
(110) Audubon's Caracara,
(111) orchids, and
(112) bromiliads.

(113) The Florida Keys are the most severely stressed areas of the state because of residential and recreational development.
(114) Many plant and animal subspecies have developed in isolation on each island and are found nowhere else on earth. There are more endangered species and subspecies in the Keys than anywhere else in Florida.
(115) The Everglades and fresh water marshes are being drained in the name of agriculture and flood control.
(116) As a result, the little blue heron,
(117) great egret,
(118) snowy egret,
(119) black crown heron,
(120) white ibis,
(121) glossy ibis,
(122) reddish egret,
(123) epiphytic orchids of all kinds,
(124) and tree snails are disappearing.

(125) As local drainage systems are redirected by land developers, plant communities surrounding sink holes are being changed from hardwood forest to pasture and paperpine. Entire populations of cave dwellers are dying. The bats are being hunted and vandalized. On the brink of extinction are...
(126) the Georgia blind salamander,
(127) cave crickets,
(128) several varieties of cave crayfish,
(129) and two species of bats.

(130) The Florida panther and black bear roam large territories in search of food and shelter. The territories are being fragmented with housing developments and highways, and thus their ability to gain food is restricted.
(131) The large predators are being killed on highways and are now easily taken by hunters who have easy access to these animals through a network of roads and off-road-vehicles.
(132) Raccoons and small rodents enjoy these simplified systems and are free from the threat of predators. They have grown in numbers

and are now considered a threat to eagles, pelicans, and marine turtles. The raccoons and rodents eat the eggs from the nests.

(133) The sea turtles are having problems in being able to lay eggs, for the building of condominiums and motels upon the sand dunes and turtle nesting beaches has deprived this animal the right to provide for future generations of its kind.

(134) The Australian pine threatens to become a monoculture in south Florida. Its thick roots form a network of sprouting branches which creates a barrier that prevents the sea turtles from digging their nests and laying their eggs in the sand above high tide.

(135) At one time in Florida, the alligator was nearly hunted to extinction, despite state laws making it illegal to do so. The huge market for the hides in the fashion centers of the world made poaching profitable, and to some, worth the risk. Ecologists discovered that the removal of these huge reptiles from the Everglades corresponded with the demise of fish, birds, and mammals during periods of drought.

(136) After studying this phenomenon they discovered that the gators made large holes in sloughs and marshes with their powerful tails. In times of drought, these gator holes retained water and sustained populations of birds, mammals, and fish. The gator performs a necessary function for the ecosystem.

(137) Improved federal laws making it a crime to take the gator hides across state lines and the outlawing of the sale of their products in the fashion centers have killed most people's incentive to poach. The gators are now appearing to be more numerous and conservation measures have been successful. Continued vigilance is necessary however, to maintain these strict laws.

(138) The Florida manatee is in danger of becoming extinct. This mammal lives in shallow water, eats only water plants and must surface in order to breathe. Manatees live near the mouths of springs and power plant outflows in winter time, for they cannot tolerate the cold.

(139) Scuba divers, boaters and fishermen also congregate in these areas in winter time and many harass the gentle manatee. Sometimes hunters kill them just because they are there. Boaters run over them with their boats either inadvertently or on purpose.

(140) Consequently the few remaining animals carry deep scars on their bodies. They suffer from exhaustion and many die from pneumonia due to forced exposure to cold water and weather. Because manatees come to Blue Springs State Park, motor boats are not permitted in the run. Manatees need such protection whenever they winter in the state.

(141) The various races of Florida tree snails are endangered due to habitat destruction and over-zealous collectors. The tree snail lives in the subtropical hammock forests in South Florida. They go about their lives eating algae off smooth barked trees.

(142) The subtropical forests are surrounded by sawgrass and marsh systems so that the hammocks are like islands in a river of grass. Through the centuries this island-living produced a separate race of tree snail for each hammock - each with its individual marking distinguishing it from others.

(143) Collectors, taken by the beauty of the shells, began collecting them. Some - wishing to have more of certain shells than anybody else - would go into a hammock, collect all the snails they could find and then burn down the hammock so that there would be no more of its kind. To the dismay of the collectors, the beautiful shell begins to fade with the death of the animal.

Other tree snails have been inadvertently destroyed when hammocks were cleared for development, as in the Keys.

(144) Wild orchids of nearly every variety are endangered. They, too live in subtropical hammocks as well as river swamps, Everglades floodplains and marshes. They are being over-collected, and their habitat is being destroyed.

(145) They represent one of the most elaborate and beautiful pollination schemes of the plant world. They exude an odor exactly like that of the mate of the pollinating insect.

(146) An insect, flying by, smells a mate and does not know it is only the plant. After mating with the orchid, the insect flies away, never the wiser. The orchid has been pollinated!

(147) Birds of prey such as the bald eagle,

(148) brown pelican, and

(149) osprey are undergoing the effects of a new means of extinction--chemical pollution. Pesticides, concentrated in their food, have already threatened these birds by causing them to lay eggs with thin shells. When the parent bird sits on the nest, the eggs are then broken. Other reproductive malfunctions such as sterility have also been noted.

(150) Since these birds of prey, like humans, are top-of-the-food-chain carnivores, people have begun wondering if man is next on the endangered species list. But if we spend years studying the effects of these toxins on ourselves, our life support system may already be in sad shape and our survival in doubt.

(151) The sensitive species of life that are dying off are danger-warning mechanisms of the ecosystems. We need to study the effects of all of our actions on these endangered plants and animals - not on ourselves - before our entire ecosystem collapses. People do not have to start dying before we can do something about maintaining our life support systems.

We need to maintain the stability of each system and subsystem in Florida;

(152) They represent those that may have dominated the earth in past ages, those that may cover the earth in the future, those that help us visualize possibilities on other planets, those that can be engineered for the benefit of man and those that have great value for scientific progress.

Each species of plant and animal occupies a different pathway of processing energy in the biosphere. They take the poisons first, and many of their populations are killed. As the levels of the wastes from our culture rise beyond the life-support system's ability to assimilate it, diversity is destroyed, and with it man's protection.

(153) The more complexity in our biosphere, the cleaner emerge the air and waters. As long as there are complex ecosystems, humankind is protected.

(154) If the diversity of our ecosystems is destroyed, then pollution can pass through the simplified ecosystem unimpaired and kill us directly.

(155) We need to monitor our ecosystems to ascertain their health just as any other management system would monitor the adequate operation of its engines.

(156) As human beings, we have the right to a safe life support system. Long taken for granted, these rights are not free, but bought and paid for by the daily functioning of our ecosystems processing the wastes and byproducts of our culture. The inner workings of the entire biosphere, which organize and manage the earth's surface, are not the property of individuals but are part of an essential basic right, a safe life support system.

(157) A new system of man and nature could be idealized as three sectors - each a full-fledged member of spaceship earth - - the urban sector, the agricultural sector, and the wilderness life support sector. All three should be equal partners in the new nature. The management of the wilderness sector should be incorporated into the economy of the other two. We should take into account the services that this sector does for the other two systems. Our value systems and our laws should reflect our partnership with nature. Upon this partnership, our destiny depends.

(158)

(159) The End

(160) This program was made possible.....

ACTIVITIES :

Take field trips to wilderness habitats near your school. Find out what animals and plants live there. Construct a food web of the habitat. Next find out what animals and plants live on your school campus. Construct a food web of this habitat. On the basis of food web comparisons decide which ecosystem is the most diverse, the most stable, the most interesting.

Conduct a school wide endangered species awareness campaign. Adopt a habitat each week and post pictures of the habitat plus the threatened species living there. Post reasons why the species are endangered and what can be done to save them. If pictures aren't available for posting, make them in class.

Hold an endangered species art show.

MODULE #3 "ENDANGERED SPECIES"

SUPPLEMENTAL AIDS:

Selection of material for this section does not constitute official endorsement or approval of it by the Florida Audubon Society, or the United States Office of Education to the exclusion of others which may be suitable.

National Wildlife Magazine ; National Wildelife Federation, April/May, 1974, Vol. 12, #3 , Washington, D.C.
Special issue devoted to endangered species

"Wildlife for Tomorrow," United States Dept. of Agriculture, Forest Forest Service. Program Aid #989, Jan. 1972, Washington D.C. Stock # 0100-1569---.60¢

Florida's Endangered Species Soon to be published by the Florida Game and Freshwater Fish Commission, Tallahassee, FL

This report inventories the cause and recommendation for protection of every endangered and threatened species of plant and animal in the state.

Information disclosed in this report was compiled by the Florida Committee on Rare and Endangered Plants and Animals, jointly sponsored by the Florida Audubon Society and the Florida Defenders of the Environment.

"Endangered Species - Nature's Early Warning Signal" , ENFO Newsletter, The Environmental Information Center of the Florida Conservation Foundation, Inc., Winter Park, FL

In an attempt to determine how badly frayed our web of life actually is, the Florida Committee on Rare and Endangered Plants and Animals has compiled the most comprehensive and complete inventory of such organisms ever undertaken. This report shows an erosion of life forms that should give any thoughtful person cause for concern.

The Peterson Field Guide Series, Roger Tory Peterson, Houghton-Mifflin Company, Boston, Mass.

Helps the field-tripper identify wildlife and plants. Birds, shells, butterflies, mammals, rocks and minerals, animal tracks, ferns, trees and shrubs, reptiles and amphibians, stars and planets, wildflowers, and insects are subjects covered by this series.

MODULE #3 "ENDANGERED SPECIES"

"The Fairest One of All" , Eastern Region of the Forest Service,
U. S. Department of Agriculture, Milwaukee, Wis.

An environmental education activity centering on endangered species.